

PACT: Performance Analysis of Cell Tracking

User Manual

PACT is a repository of code that provides a way to compute the performance evaluation metrics, SFDA and ATA, described in the paper “Comprehensive and standardized metrics for the performance evaluation of cell-tracking algorithms.”

This manual describes

- 1) Functions in the repository.
- 2) Input file formats for tracking-results and ground-truth data.
- 3) Description of the ViPER tool for authoring ground-truth.

1) Functions in the repository

The primary function in the repository used to carry out performance analysis is called `main.m`. This function makes calls to the functions `pm_sfda.m` and `pm_ata.m`, as well as other helper functions, in order to compute the performance metrics. This function can be invoked with the following MATLAB command:

```
[SFDA, ATA] = main(groundtruthFileString, trackingResultsFileString)
```

Inputs to `main.m`:

- a) `groundtruthFileString` contains the path to a ground-truth file, which should be in one of the formats described in Section 2.
- b) `trackingResultsFileString` contains the path to a tracking-results file, which should be in one of the formats described in Section 2.

Outputs of `main.m`

- a) `[SFDA,ATA]`, a vector of two values, the SFDA and ATA.

2) Input file formats for tracking-results and ground-truth data

Standard .csv format:

For both tracking-results and ground-truth data, one option is to put either into a standard .csv format.

The .csv format:

```
cellIndex_1
frameIndex_1,minX,minY,width,height
frameIndex_2,minX,minY,width,height
...
frameIndex_final,minX,minY,width,height
cellIndex_2
frameIndex_1,minX,minY,width,height
...
```

An example:

```
1
1,10,11,25,23
2,12,12,25,24
3,14,13,25,25
4,16,15,25,23
5,17,16,25,25
2
1,45,200,10,14
2,46,198,12,13
3,47,197,12,14
3
1,150,152,30,20
2,152,154,31,21
3,154,156,30,21
4,156,158,34,22
5,158,160,30,21
```

TIAM .mat tracking-results input file:

The MATLAB .mat workspace produced by running TIAM on a cell video (of the form filename.mat) can also be used as tracking-results input. During a run of TIAM, a user will enter a size conversion coefficient (“micrometers per pixel”) that allows TIAM to produce results in micrometer units. This same conversion coefficient must be given as a final parameter when TIAM results are used. In this case, the call to compute the metrics is written:

```
[SFDA, ATA] = main(groundtruthFileString, trackingResultsFileString,  
sizeConvertCoefficient)
```

where the trackingResultsFileString is the MATLAB .mat workspace file of the form filename.mat.

ViPER .txt ground-truth input file:

The ViPER tool is an open source, easy-to-use tool for authoring ground-truth (and was used by the authors of this project for all ground-truth). A description of ViPER and how to use it to author ground-truth are given in Section 3. ViPER gives as an output a .txt file that can be used directly by the main.m function. In this case, the groundtruthFileString input parameter should be replaced with the ViPER output file, filename.txt.

3) Description of the ViPER Tool for Authoring Ground-Truth

The ViPER tool is an open source tool that can be used to author ground-truth from a video of cells. It can be downloaded from:

<http://vipertools.sourceforge.net/>

After downloading, the ViPER tutorial, found here

<http://vipertools.sourceforge.net/docs/gt/4.0/tutorial/>

can be used to author ground-truth.

Afterwards, output should be exported from ViPER as .txt file to be used with the main.m function described in Sections 1 and 2.

ViPER official documentation can be found at:

<http://vipertools.sourceforge.net/docs/>